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METEOROLOGICAL FACTORS . . . PREDICTING MISSION SUCCESS

by

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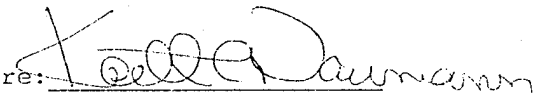
A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Joint Military operations Department.

The contents of this paper reflect my personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

Signature: 

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METEOROLOGICAL FACTORS . . . PREDICTING MISSION SUCCESS

TABLE OF CONTENTS

ABSTRACT

In war weather is rarely neutral. History has repeatedly demonstrated that climate and weather provide an advantage to the side whose tactics, technology and training are best suited for the prevailing meteorological conditions. In the application of joint combat power, climatic and meteorological conditions represent important quantitative and qualitative factors for the operational commander to ponder. This paper will examine the impact that regional climatology and meteorology have on the various elements of operational design. Further emphasis will be placed on the physical restriction presented by climatic conditions and their importance as elements of the deliberate and crisis action planning process. Finally, the importance of long-range predictions and short-range outlooks as key factors in the both the deliberate and crisis action planning process will be examined.

METEOROLOGICAL FACTORS . . . PREDICTING MISSION SUCCESS

And therefore I say, "Know the enemy, know yourself; your victory will never be endangered. Know the ground, know the weather; your victory will then be total."

Sun Tzu[1]

INTRODUCTION

In war weather is rarely neutral. History has repeatedly demonstrated that climate and weather provide an advantage to the side whose tactics, technology and training are best suited for the prevailing meteorological conditions. In Southeast Asia climate and weather proved to be invaluable allies of the North Vietnamese who skillfully incorporated seasonal and weather conditions into operations and tactics as force multipliers. In contrast, those same factors; monsoon rains, high temperatures and humidity were U.S. enemies, negating superiority in air power, mobility and technology.

"Unlike the relatively predictable environment of the Cold War, we are now faced with much uncertainty in a world of rapidly accelerating change . . . . This is a different - decidedly different - challenge from what we faced only a few years ago".[2] In the application of joint combat power, climatic and meteorological conditions represent important quantitative and qualitative factors for the operational commander to ponder. Not only are they fundamental defining characteristics of the area of operation and enablers of mobility, technology and sustainment, but they also promote joint force synergy and interact with friendly and enemy forces as either combat force multipliers or reducers.[3] Meteorological conditions can not guarantee operational success, however if understood and exploited, they have the capacity to ensure mission failure.

Arguably, all the geophysical factors play an equally

important role in modern operational warfare. Nonetheless, a discussion of oceanography, hydrography, and topography are considered beyond the scope of this paper. Accordingly, this commentary will focus on the impact that regional climatology and meteorology will have on the various elements of operational design. Further emphasis will be placed on the physical restriction presented by climatic conditions and their importance as key factors in the sequence of action leading to the operational goal.

Finally, the importance of long-range predictions and short-range outlooks as key factors in both the deliberate and crisis action planning process will be examined. The operational commander who pursues innovative methods for incorporating climatological and meteorological predictions into the planning process will facilitate mission success.

CLIMATIC FACTORS

> The Armed Forces of the United States face the most challenging environment of any military power. . . . The strategic context confronting the United States is unique, and our friends, allies, and interests are worldwide. Accordingly, the arena of our potential operations is the entire planet. . . . We must be prepared to defend our national interests in every type of terrain and state of sea and air, from jungles, desert, and tropical seas to polar ice caps. [4]

The characteristics of the designated area of operations will play a major role in the deployment, employment, and sustainment of U.S. Armed Forces. Given the global scope of U.S.

commitments and the potential for military intervention world wide, the four climatic regions (cold, temperate, desert and tropical) and associated meteorological conditions represent fundamental characteristics in defining potential areas of operation and in this connection, serve as underpinnings for the operational scheme and its execution.

THE COLD REGION. The cold regions of the world are those areas north of 40 degrees latitude in North America and 50 degrees latitude in Europe and Asia. The only cold region in the southern hemisphere is in the Antarctica. Cold regions comprise approximately 45 percent of the earth's land area and are sparsely populated. Their principal distinguishing characteristics are temperature, moisture, pressure and wind. As a result, cold region are subject to dew, fog, clouds and precipitation in the form of rain, sleet and snow.[5]

"Although fewer conflicts have occurred in cold regions than elsewhere in the world, those few conflicts have been devastating in terms of loss and property damage".[6] For example, Napoleon suffered 40,000 casualties in four days during his withdrawal from Russia; the Soviet Union lost 48,000 men, mostly from frostbite, during the war with Finland in 1939; Operation Barbarossa resulted in 100,000 casualties from frostbite; and the U.S. in Korea suffered 7,000 casualties from frostbite in just two months.[7]

The impact of climate and weather are major considerations for the operational commander. Cold temperatures reduce the

effectiveness of batteries; greases and oils thicken; seals and O-rings become brittle; brakes and transmissions fail; fuel lines freeze and clog; machinery and aircraft require extra warm-up time; topside icing on ships can limit all operations; sea ice may make surface movement hazardous; winds and temperature may restrict amphibious operations; aircraft icing may preclude flight operations; ice, fog and white-out conditions may restrict flight operations;[8] artillery may be totally roadbound; preparation of artillery positions may require additional time and as a result the infantry may move faster than artillery can be repositioned; artillery range will decrease (100 meters per 1,000 meters of range) and ammunition effectiveness will be reduced in deep snow; and the metal on small arms can become so brittle that rifles break.[9]

In addition, the same conditions place tremendous pressure on operational sustainment. Operations in cold regions require special equipment (heaters, plows, snowshoes, etc.,); food and fuel consumption is higher; water-soluble medicines and plasma will freeze; high static electricity and the threat of instant frostbite create challenges in fuel storage and handling; maintenance and repair time increases; lines of communication (LOCs) are restricted and therefore vulnerable. Compensating for these weather induced exigencies -- limited LOCs and centralized weather protected storage -- can create a lucrative target for the enemy.[10]

Equally important to the operational commander, are the

intangible hazards posed by cold to military operations. "In cold climates, survival rapidly becomes the major concern".[11] The cold has a far reaching affect on the physical and psychological well being of personnel which is evidenced, by the increased time it takes to execute tasks in cold weather. In short, climate and meteorological conditions will have a decisive impact on virtually every element of the operational scheme.[12]

"In a cold region, the environment favors the defense, because a unit that moves is vulnerable. The battle cannot be won without offensive action at some juncture, but that action must be lightning quick with limited objectives."[13] The operational commander should plan to take offensive action only after giving careful consideration to the effect that weather will have on the principal elements of the operational design. In addition, the operational commander must understand the prominence of operational pause as a means of preserving resources and delaying the culminating point of the offense. Summarily, in the cold region climatology will be a major determining factor in delineating what the operational commander is able to do and how he will do it.

THE ARID REGION. On the opposite end of the climatological scale, arid regions are characterized by predominantly clear sky conditions and intense heat. Arid regions comprise approximately one third of the earth's surface. Defined primarily by climatic conditions rather than a specific range of latitudes, arid regions are distinguished by high temperatures and low relative

humidity.[14]

In a desert environment, intense solar radiation and clear sky conditions can produce temperatures ranging from 140 to -50 degrees Fahrenheit. Of note, arid regions do experience intense rain and thick fog. Finally, intense thunderstorms, windstorms, and temperature represent the principal meteorological factors affecting operations.[15]

> About three hours after leaving the Nimitz's decks, one RH-53D had already aborted due to mechanical difficulties, and the other seven ran into a cloud of suspended dust some forty-seven nautical miles east-northeast of Bam. It turned our to be the first of several areas of suspended dust, together spanning 190-200 nautical miles on the lee side of the Zagros. Visibility deteriorated to the point where the helicopters crews could not maintain visual contact with each other or with ground reference. {Abort at Desert One: Iran, 1980}[16]

The predominant considerations in the desert are the hazards posed by high temperatures, wind and the sun's rays. The influence on the physical and psychological well being of personnel is substantial. Acclimation time of two to four weeks may be required to optimize personnel performance. Even after acclimation, sun burn, eye injury and the monotony of the desert will continue to take their toll.[17] Moreover, the high temperatures and low relative humidity can cause intense evaporation, subjecting personnel to heat exhaustion and heat stroke. "A solider may lose six quarts of liquid per day doing light work or 13 quarts a doing heavy work."[18]

Climatic conditions also have a tangible impact on equipment. "With each ten-degree rise in temperature above 60

degrees Fahrenheit, a one percent loss in vehicle power can be expected. In the heat of the day, this can mean a loss of six to seven percent."[19] Significantly, intense heat affects sensitive electronic equipment; equipment cooling systems need constant monitoring; extreme fluctuations between night and day time temperatures can result in over-inflated tires and over-filled fuel tanks; weapons over heat quickly, increasing wear, maintenance and creating potential for malfunctions; heat shimmer distorts target acquisition and target solutions; and wind blown sand reduces visibility and penetrates everything from weapons systems to fuel. Further, high temperatures dramatically impact aviation by reducing lift capability for fixed and rotary wing aircraft.[20] "FM communications range can be reduced by as much as 50 percent because of high temperature."[21]

"Complex electro-optic targeting systems developed and fielded over the last 10 years are giving allied aircraft supporting Operation Desert Storm a degree of bombing accuracy unprecedented in air warfare."[22] Clear skies and the absences of clouds enables mobility and the unrestricted use of technology. Meteorological conditions are ideal for precision guided munitions, imagery intelligence gathering, and air power projection. Daytime heat can shorten communications ranges while, nighttime temperature can significantly increase range.

If the cold region favors the defense, then the arid region favors the offense. The desert's climate and predominant good weather reward an operational design that exploits mobility, and

technology, and joint force synergy. Thereby, the climatic and meteorologic characteristics of the region allow the operational commander to establish the situational awareness needed to exploit the "non-linear" battlefield. Accordingly, superior military force can be applied at a rate that exceeds the enemy's ability to respond. It follows that the synergistic impact of operational sequencing, synchronization, phasing, as well as, envisioned branches and sequels of opportunity will result in an operational tempo conducive to quick, decisive mission success.

THE TROPICAL REGION.

> South of the Demilitarized Zone (DMZ), Ho Chi Minh's forces lacked airpower of any kind, so their intelligent counter was to take advantage of poor weather and darkness whenever possible. Quite logically, the VCs largest offensive [Tet offensive] of the war began during the evening hours of January 30, 1968, at the height of the northeast monsoon.[23]

The tropical regions comprise approximately 20 percent of the earth's surface and are primarily situated between 20 degrees latitude north and 20 degrees latitude south. The principal climatic factors are year-round hot temperatures, high rainfall, and high humidity. Precipitation, the only variable in the tropical climate, separates the tropics into three sub-climates; rain forest, monsoon, and savanna. In the rain forest, afternoon clouds and rains are normal. In contrast, the monsoon experiences constant cloud cover, heavy precipitation and fog during its rainy season. The savanna's wet season is much drier than either the monsoon or the rain forest. Of note, the entire

tropical region is subject to storms ranging from severe thunderstorms to typhoons.[24]

Like the cold and arid regions, the tangible and intangible influence of climate and weather on military operations are significant. "The heat and wetness of the tropics take a heavy toll on the soldier, both physically and psychologically. . . . The excessive moisture of the tropics is also a major problem for vehicles, weapons, and other equipment and facilities."[25] In addition, the climate is a fertile ground for the propagation of insects and disease. "The weather does not permit the indiscriminate use of such massive firepower; additionally, the terrain often reduces the effects of munitions. Both the weather and the terrain reduce the freedom of movement of patrols." [26] Equally, important is the strain placed on the logistic system to transport, store and distribute ammunition and supplies.

Finally, hurricanes, typhoons, and thunderstorms add a new dimension with a potentially catastrophic impact on the commander's operational design. As Capt. Conley R. Ward, aerologist on USS Oriskany expressed it, "Leave Yankee Station too soon or unnecessarily, and you miss superb bombing weather. Wait too long and you court disaster!"[27]

The climate and weather of the tropics, like the desert, favor offensive operations. The tropical region, as the U.S. learned in Vietnam, is ideally suited to a guerrilla style of warfare. In the tropical region the operational commander will have to cope with restrictions to mobility and technology. As a

result, defendable bases of operation and lines of communication will be the cornerstone of operation sustainment. In the final analysis, mission effectiveness will be defined by the operational commander's ability to execute an operational scheme that comprehends the cumulative impact of climate and weather.

THE TEMPERATE REGION. The temperate region of the world are situated between 20 and 40 degrees latitude in both the northern and southern hemispheres. While the temperate regions represent only five percent of the earth's land surface, they are densely populated and prone to conflict. The climate in the temperate region is typified by four distinct seasons. The defining meteorological conditions are the dramatic and rapid changes caused by rival low-pressure and high-pressure systems. These changes are responsible for winds, precipitation, temperature extremes and restricted visibility. In addition, thunderstorms, tornadoes and hurricanes further impede military operations.[28]

"Once again, weather defeated the American peacekeeping operation in Bosnia, with planes unable to land at the airport here for the forth consecutive day because of heavy fog."[29] Although, the conditions are less extreme than the cold region, meteorological factors associated with the temperate region can profoundly impact the operational plan. The temperate region is a chameleon. In the summer, it resembles the tropical region, while in the winter it adopts the characteristics of the cold region. However, it is the rapidity and magnitude of the changes associated with the frontal conditions that create the greatest

challenge to the operational commander. Consideration must be given not only to the impact of seasonal extremes (previously discussed in the cold and tropical regions), but also to the effect that the short-range synoptic situation will have on equipment, mobility, and technology. An additional consideration, is the impact of prolonged periods of bad weather on the physical and psychological well being of personnel.

> On 18 December 1944, vessels of the Pacific Fleet, operating in support of the invasion of the Philippines in an area about 300 miles east of Luzon, were caught near the center of a typhoon of extreme violence. Three destroyers . . . capsized and went down with practically all hands; serious damage was sustained by CL Miami, Cowpens, and San Jacinto, the CVEs Cape Esperance and Altamaha and DDs Aylwin, Dewey, and Hickox. Lesser damage was sustained by at least 19 other vessels . . . . 146 planes were lost or damaged . . . . About 790 officers and men were lost or killed and 80 were injured . . . .[30]

Also of great significance, are the various major storms produced by frontal systems. Hurricanes and typhoons with high winds, intense rain and waves represent a significant threat to debarkation sites, bases of operations, and lines of communication. Although, normally localized and of relatively short duration, thunderstorms with high winds, heavy rain and lighting are a serious threat to personnel, equipment and vehicles in the open.[31]

" Ugljevik, Bosnia. Our troops live here in tents pitched on the mud flats. . . . you walk through mud to get from the paved helicopter landing area to the tents. You also must walk through the mud to get to the outdoor privy . . ."[32] In short, weather can have a profound impact on terrain, resulting in mud and

conditions that significantly impede military operations. More importantly, frontal systems can influence weather conditions over the entire area of operations producing unseasonable temperature, rain, fog, ice, snow, clouds, and reduced visibility that last for weeks.[33] "In many cases, the combination of weather and terrain has outweighed the effect of good tactics and firepower and the courage of soldiers on the battlefield."[34]

THE OPERATIONAL PLAN

During deliberate and crisis action planning, climatology and meteorology represent important quantitative and qualitative factors for the operational commander to ponder in the application of military power. The operational commander will be confronted with the deployment, employment and sustainment of forces in geographic regions spanning a spectrum of climatic and meteorological possibilities, and a range of conflict from war to MOOTW.

During deliberate planning execution is unknown, as a result climate and weather assessments are "broad brush" and routinely relegated to the realm of assumption and secondary importance. In contrast, the immediacy of crisis action planning makes short-range synoptic picture germane and elevates the importance of meteorological factors. Therein, the inherent differences between deliberate and crisis action planning will result in distinctly different application of climatic and meteorologic predictions.

DELIBERATE PLANNING. "Deliberate planning is conducted

principally in peacetime to develop joint operations plans for contingencies identified in strategic planning documents."[35] Deliberate plans include campaign plans (initial phase) and functional plans and depend on assumptions based on climatology and long-range outlooks. The operational commander's planning decisions will nominally be based on prognostications that support a qualitative assessment of the influence of climate and weather on the operational idea. Of note, climatological considerations are primarily the focus of the operational and theater-strategic level planner during deliberate planning process.[36]

The weather input to the deliberate planning process will be narrower in scope than in crisis action planning and will rely heavily on historical climatological analysis to provide a broad weather related view of the area of operation. This long-range outlook will be obtained from sophisticated high resolution global and regional computer models from the Navy's Fleet Numerical Meteorological Center[37] and USAF Environmental Technical Application Center.[38] Realistically, climatological assumptions are at best ancillary considerations during the formulation fo the operational course of action. Consequently, the more distant contingency execution becomes, the more superficial the correlation between the operational plan and the influence of climatological and meteorological factors.

However, climatological conditions in any specific area of operations have the capacity to dramatically alter both friendly

and enemy capabilities, as well as the suitability, feasibility, and acceptability of the operational plan. The operational commander must plan for the worst case, with due consideration of the importance that changeable climatological situations pose to the key elements of the operational plan.

CRISIS ACTION PLANNING. "Crisis action planning is based on current events and conducted in a time-sensitive situation . . . . Crisis action planners base their plan on the actual circumstances that exist at the time planning occurs."[39] Crisis action plans, campaign plans (execution phases) and selected functional plan are prepared for immediate execution and as a result, are heavily dependent on current information, existing meteorological conditions and short-range predictions. In contrast to deliberate planning, the crisis action planning process normally occurs simultaneously from the strategic to the tactical level. Lastly, operations may be exposed to multiple seasons and a variety of meteorological conditions based on the scope and duration of the mission.

Like deliberate planning, crisis planning will be heavily dependent on technology to aid the planning process. The operational commander will rely on a blend of climatological and near real-time meteorological information. Weather data and observations collected from civil and military sources worldwide will be systematically analyzed, sorted, and consolidated with overhead data, then distributed to the operational commander.[40] As Don Veazy of the Army Research Laboratory describe, "When the

commander knows the disadvantages of the weather, he'll know what weapons - his own and the enemy's - will work best. He'll be able to more knowledgeably choose his tactics and decide when and where to fight."[41]

Navy meteorological information is tailored to support specific fleet requirements by the Tactical Environmental Support System (TESS). TESS is integrated into the Department of Defense worldwide command and control, communications, computers and intelligence (C4I) network and is installed on all major combatants and shore stations. TESS supports the operational commander by allowing the integration of external and internal meteorological data into various tactical decision aids to support fleet operations.[42] Another important ingredient, is the Integrated Meteorological System (IMETS) that provides a similar capability to the Air Force and Army. IMETS, available at every echelon supported by an Air Force weather team, facilitates the utilization of tactical decision designed to support both Air Force and Army operations. Of note, both TESS and IMETS are designed as either "push" or "pull" systems capable of to providing as well as requesting weather information.[43]

"Night and adverse weather conditions have the potential to affect every combatant, piece of equipment, and operation. It also affects the decisions of both forces."[44] In spite of modern technological advances, accurate weather forecasting is still limited to something less than 48 hours. However, critical planning evolutions like the air task order (ATO) and

intelligence preparation of the battlefield (IPB) operate on time-lines commencing 72 hours prior to execution. Essentially, the operational commander lacks a vital element of information - weather - even after the "count down" has started. Viewed in this light, it becomes clear that the operational commander's scan must include the impact of meteorological factors on the operational scheme during the planning and execution phases.

Ultimately, the shorter the time to execution, the more critical the correlation between the operational plan and the influence of climatological and meteorological factors becomes. In contrast to deliberate planning, crisis action planning hinges on an current and synoptic picture to control elements of the operational scheme. Therein, branches will be planned and sequels will be executed based on forecast and actual weather. As a result, operational decisions will be based on quantitative assessment of both climatological and meteorological data.

CLIMATOLOGY AND METEOROLOGY APPLIED. The operational commander is responsible for evaluating the relative importance of specific climatological and meteorological factors on the elements of the operational plan. Developing charts of climatological and meteorological conditions will facilitate the depiction and comparison of weather related measures of influence (MOI) on operational design activities and specific elements of the operational scheme. Therein, a modest visual presentation of climate or weather has the potential to significantly enhance the situational awareness of the operational commander, "a picture is

worth ten thousand bytes". The figures 1 and 2 (see Appendixes A-1 and A-2) represents examples of qualitative and quantitative measures of influence (MOI) of climatology and meteorology on specific elements of the operational plan. The MOIs provide the operational commander the following:

> A subjective (deliberate plan) or objective (crisis action plan) measures of influence for either climatological or meteorological factors on specific operational elements as they relate to friendly and enemy capabilities.

> A standard for comparing the relative influence of climatological or meteorological factors.

> A baseline for COA revalidation based on weather.

> A means to identify degradations of operational capability due to weather [45]

The defining elements of the charts can be modified as required to suit the operational situation. Various symbols or numbers can be used to depict the level of influence. Finally, the operational commander can vary elements and measures to deal with climatic and weather variables that pose the greatest threat to the operational plan.

Figure 1, represents an example of a qualitative evaluation and comparison of climatological conditions on specific elements of friendly and enemy activities that could be part of a deliberate planning process. The operational plan is for possible military operations in a cold region. Of note, colors have been chosen to display the relative weigh of influence of

the MOIs due the subjective nature of the plan.

Figure 2, depicts a quantitative appraisal of the impact of meteorological factors on specific elements of the operational plan. The chart reflects the initiation of military operations in an arid region. Accordingly, numbers have been use to display an objective evaluation of the relative influence of forecast weather at the start of the operation.

CONCLUSION

Military operations are no longer entirely at the mercy of adverse climate and weather conditions, but now, more than ever, they are heavily influenced by them.[46] In spite of modern technological advances, control of climate and weather remains beyond our grasp. As a result, climatological and meteorological factors remain pivotal in defining the characteristics of the modern battlefield. For the U.S. operational commander who is counting on mobility, technology, and sustainability to serve as the underpinning of operational design, climate and weather remain key enabling elements. The judicious application of historical climatological analysis during deliberate planning will allow the operational commander to identify training, technology, and tactics needed to accomplish a future objective. While, current and forecast weather will reveal permit how to employ forces in an operational scheme that gives U.S. forces an immediate advantage while placing the enemy at a disadvantage.

Ultimately, it will be the operational commander's

understanding of the qualitative and quantitative attributes of climate and weather, and his ability to blend then into his operational design that will enable mission success. In the application of joint combat power, climate and weather are powerful force multipliers and reducers. In this connection, weather could be the deciding factor which enables the operational commander to accelerate his decision making cycle and seize the initiative from the enemy. Meteorological factors can not guarantee total victory, but if accurately appraised and exploited, can have a significant relevance to predicting mission success.

> It is peculiar, that while weather has always been a factor in the prosecution of wars, that as military technology has advanced and become more complex, military operations have become more sensitive to the environment.
>
> Adm. Thomas H. Moore[47]

APPENDIX A-1

MEASURES OF INFLUENCE (MOIs) FOR CLIMATOLOGICAL PREDICTIONS

COLD REGION

	WINTER	SPRING	SUMMER	FALL
DEPLOYMENT				
AIR	RED(#)	GREEN	GREEN	YELLOW
SEA	RED(#)	YELLOW	GREEN	YELLOW
SURFACE	RED(#)	RED(#)	GREEN	YELLOW
EMPLOYMENT				
AIR(F)	RED(#)	YELLOW	GREEN	GREEN
AIR(E)	YELLOW	YELLOW	GREEN	GREEN
LAND(F)	RED(#)	YELLOW	GREEN	YELLOW
LAND(E)	YELLOW	YELLOW	GREEN	GREEN
SUSTAINMENT(F)	RED(#)	RED(#)	GREEN	YELLOW
SUSTAINMENT(E)	YELLOW	YELLOW	GREEN	GREEN

(F) FRIENDLY

(E) ENEMY

(#) LIMITING ENVIRONMENTAL FACTOR

GREEN- NO RESTRICTION

YELLOW- LIMITED RESTRICTION

RED- SEVERE RESTRICTIONS

FIGURE 1

APPENDIX A-2
MEASURES OF INFLUENCE (MOIs) FOR METEOROLOGICAL FACTORS
ARID REGION

OPERATIONAL ELEMENT	TIME		
	24 HOURS	48 HOURS	72 HOURS
MANEUVER			
ARMOR(F)	(4)	(2)	(1)
ARMOR(E)	(4)	(3)	(2)
AIRBORNE(F)	(5)	(2)	(2)
AIRBORNE(E)	(5)	(2)	(2)
ROTARY(F)	(4)	(1)	(1)
ROTARY(E)	(5)	(3)	(1)
AMPHIBIOUS(F)	(4)	(2)	(2)
AMPHIBIOUS(E)	(5)	(4)	(4)
FIRES			
TACAIR(F)	(3)	(2)	(1)
TACAIR(E)	(5)	(4)	(2)
ARTILLERY(F)	(4)	(2)	(1)
ARTILLERY(E)	(5)	(2)	(1)
NGFS(F)	(4)	(2)	(2)
NGFS(E)	N/A	N/A	N/A

(F) FRIENDLY
(E) ENEMY

(1) - NO RESTRICTION
(2) - MINOR RESTRICTION NO IMPACT ON ELEMENT
(3) - LIMITED REDUCTION IN EFFECTIVENESS OF ELEMENT
(4) - SEVERE RESTRICTIONS AND DEGRADATION TO ELEMENT
(5) - PROHIBITED

FIGURE 2

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